2122 #4d
10-5-01

Parson 3-2-1-4

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): D.E. Parson et al.
Case: 3-2-1-4
Serial No.: 09/583,057
Filing Date: May 30, 2000
Group: 2763
Examiner: To Be Assigned

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Signature: Denise A. Glaser Date: September 26, 2001

Title: Control Method and Apparatus for Testing of Multiple Processor Integrated Circuits and Other Digital Systems

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TRANSMITTAL OF FORMAL DRAWINGS

Assistant Commissioner for Patents
Washington, D.C. 20231

Attention: Official Draftsperson

Sir:

Applicants submit herewith five (5) sheets of formal drawings in the above-referenced application.

Respectfully submitted,

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Date: September 26, 2001

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FIG. 1

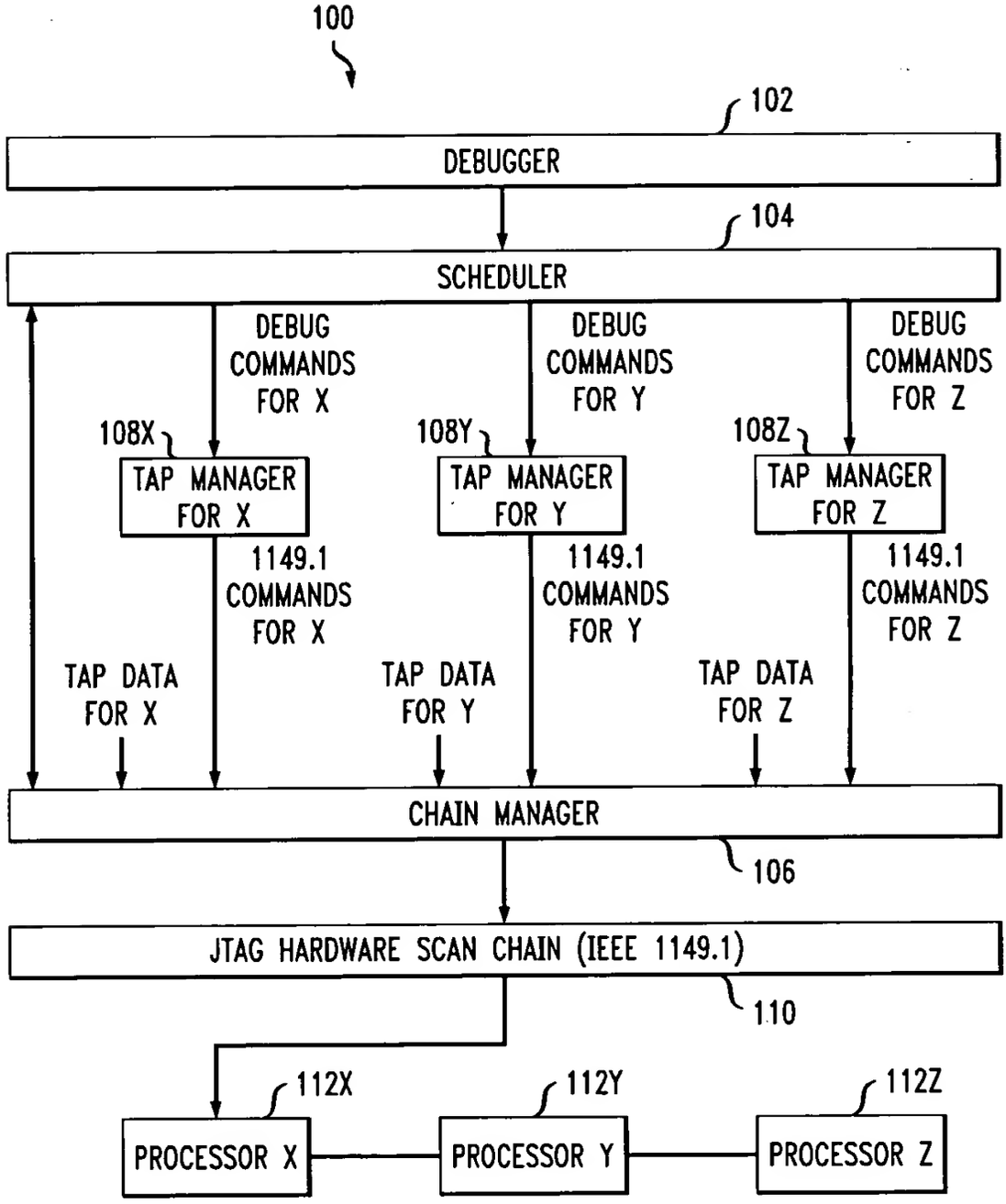

100
102
DEBUGGER
104
SCHEDULER
DEBUG COMMANDS FOR X
DEBUG COMMANDS FOR Y
DEBUG COMMANDS FOR Z
108X
108Y
108Z
TAP MANAGER FOR X
TAP MANAGER FOR Y
TAP MANAGER FOR Z
1149.1 COMMANDS FOR X
1149.1 COMMANDS FOR Y
1149.1 COMMANDS FOR Z
TAP DATA FOR X
TAP DATA FOR Y
TAP DATA FOR Z
CHAIN MANAGER
106
JTAG HARDWARE SCAN CHAIN (IEEE 1149.1)
110
112X
112Y
112Z
PROCESSOR X
PROCESSOR Y
PROCESSOR Z

FIG. 2

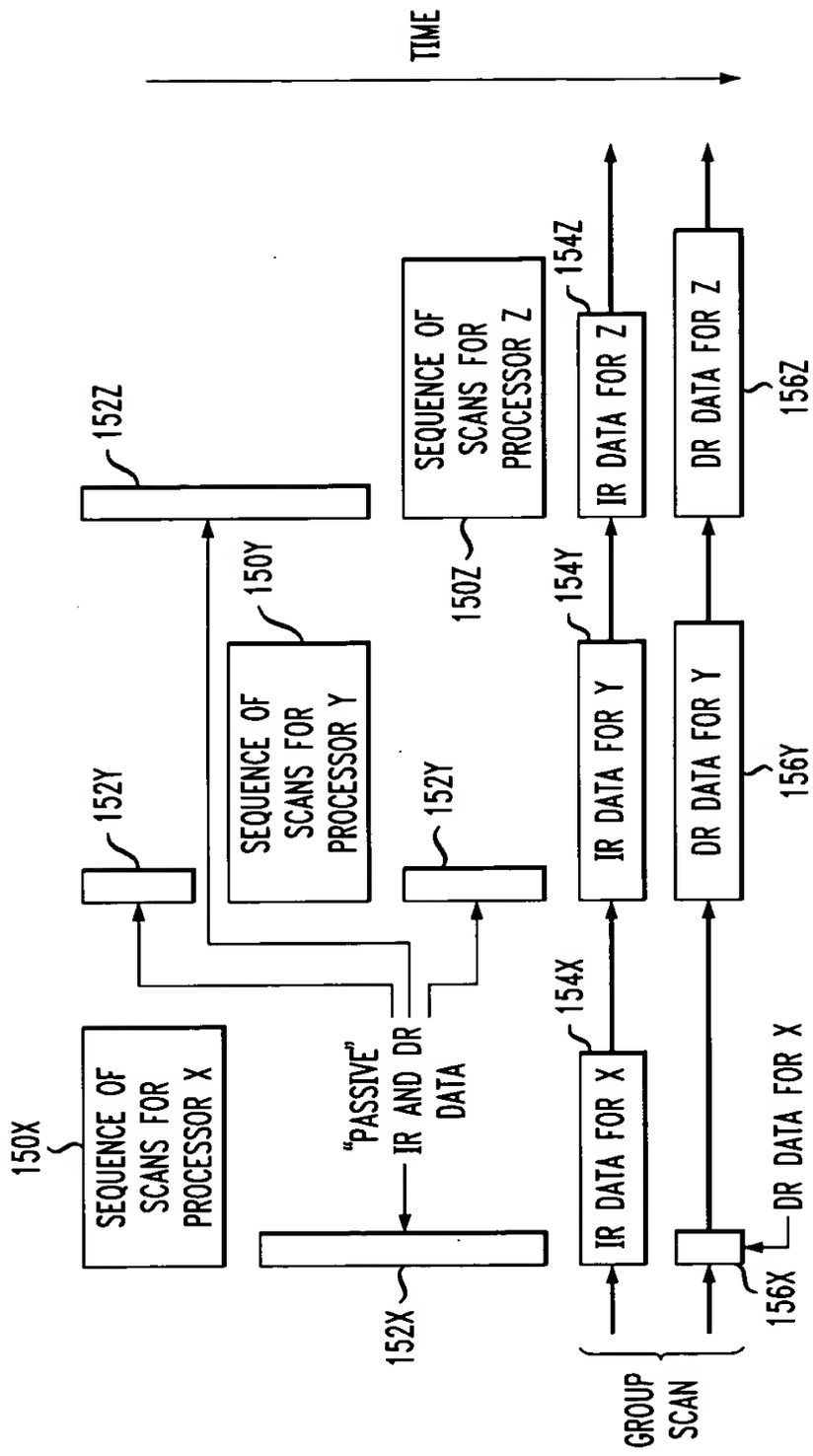

TIME
150X
SEQUENCE OF SCANS FOR PROCESSOR X
"PASSIVE" IR AND DR DATA
152X
152Y
SEQUENCE OF SCANS FOR PROCESSOR Y
150Y
152Z
SEQUENCE OF SCANS FOR PROCESSOR Z
150Z
154X
IR DATA FOR X
154Y
IR DATA FOR Y
154Z
IR DATA FOR Z
156X
DR DATA FOR X
156Y
DR DATA FOR Y
156Z
DR DATA FOR Z
GROUP SCAN

FIG. 3

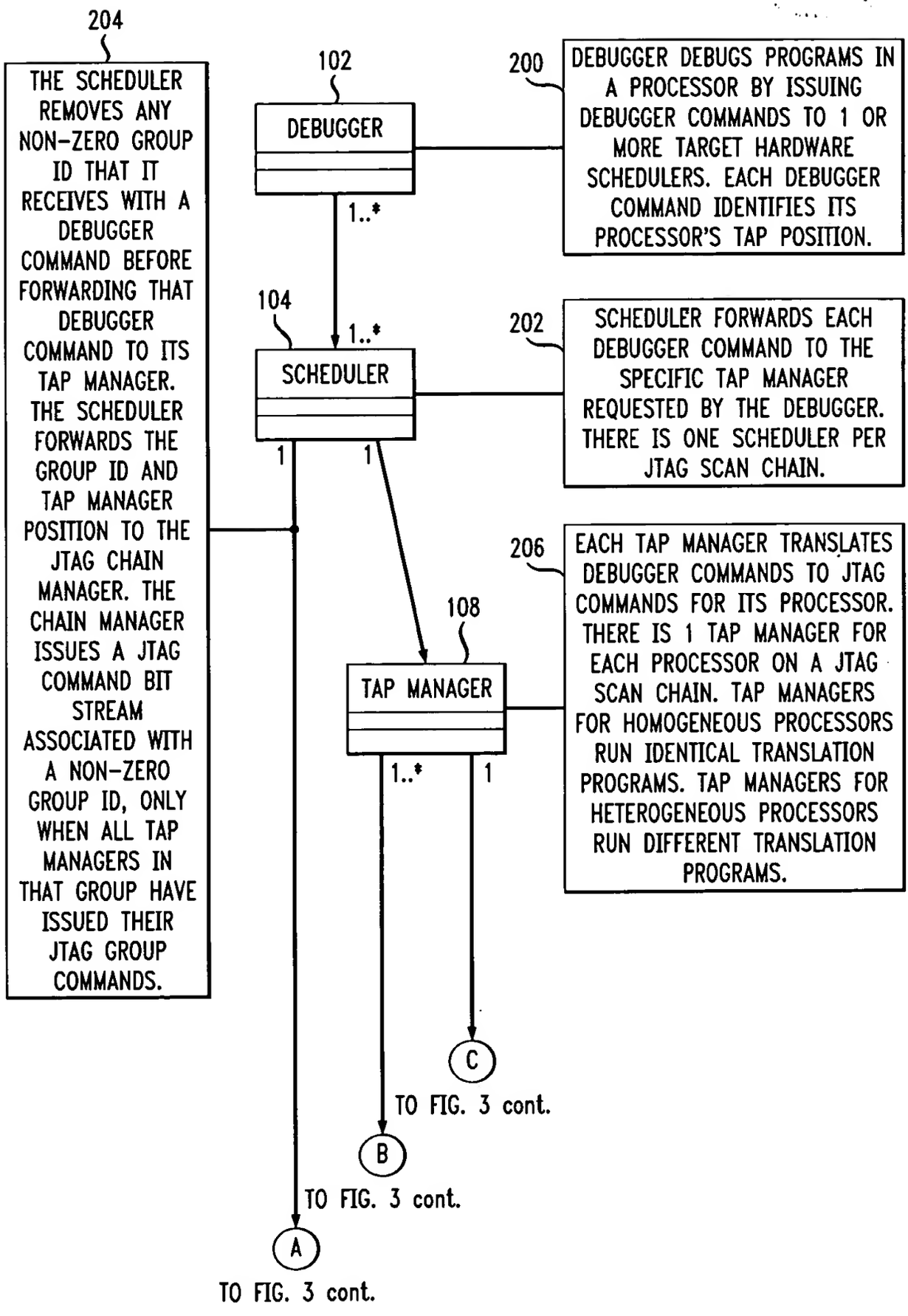

204
THE SCHEDULER REMOVES ANY NON-ZERO GROUP ID THAT IT RECEIVES WITH A DEBUGGER COMMAND BEFORE FORWARDING THAT DEBUGGER COMMAND TO ITS TAP MANAGER. THE SCHEDULER FORWARDS THE GROUP ID AND TAP MANAGER POSITION TO THE JTAG CHAIN MANAGER. THE CHAIN MANAGER ISSUES A JTAG COMMAND BIT STREAM ASSOCIATED WITH A NON-ZERO GROUP ID, ONLY WHEN ALL TAP MANAGERS IN THAT GROUP HAVE ISSUED THEIR JTAG GROUP COMMANDS.
102
DEBUGGER
200
DEBUGGER DEBUGS PROGRAMS IN A PROCESSOR BY ISSUING DEBUGGER COMMANDS TO 1 OR MORE TARGET HARDWARE SCHEDULERS. EACH DEBUGGER COMMAND IDENTIFIES ITS PROCESSOR'S TAP POSITION.
1..*
104
SCHEDULER
1..*
202
SCHEDULER FORWARDS EACH DEBUGGER COMMAND TO THE SPECIFIC TAP MANAGER REQUESTED BY THE DEBUGGER. THERE IS ONE SCHEDULER PER JTAG SCAN CHAIN.
1
1
206
EACH TAP MANAGER TRANSLATES DEBUGGER COMMANDS TO JTAG COMMANDS FOR ITS PROCESSOR. THERE IS 1 TAP MANAGER FOR EACH PROCESSOR ON A JTAG SCAN CHAIN. TAP MANAGERS FOR HOMOGENEOUS PROCESSORS RUN IDENTICAL TRANSLATION PROGRAMS. TAP MANAGERS FOR HETEROGENEOUS PROCESSORS RUN DIFFERENT TRANSLATION PROGRAMS.
108
TAP MANAGER
1..*
1
C
TO FIG. 3 cont.
B
TO FIG. 3 cont.
A
TO FIG. 3 cont.

FIG. 3 cont.

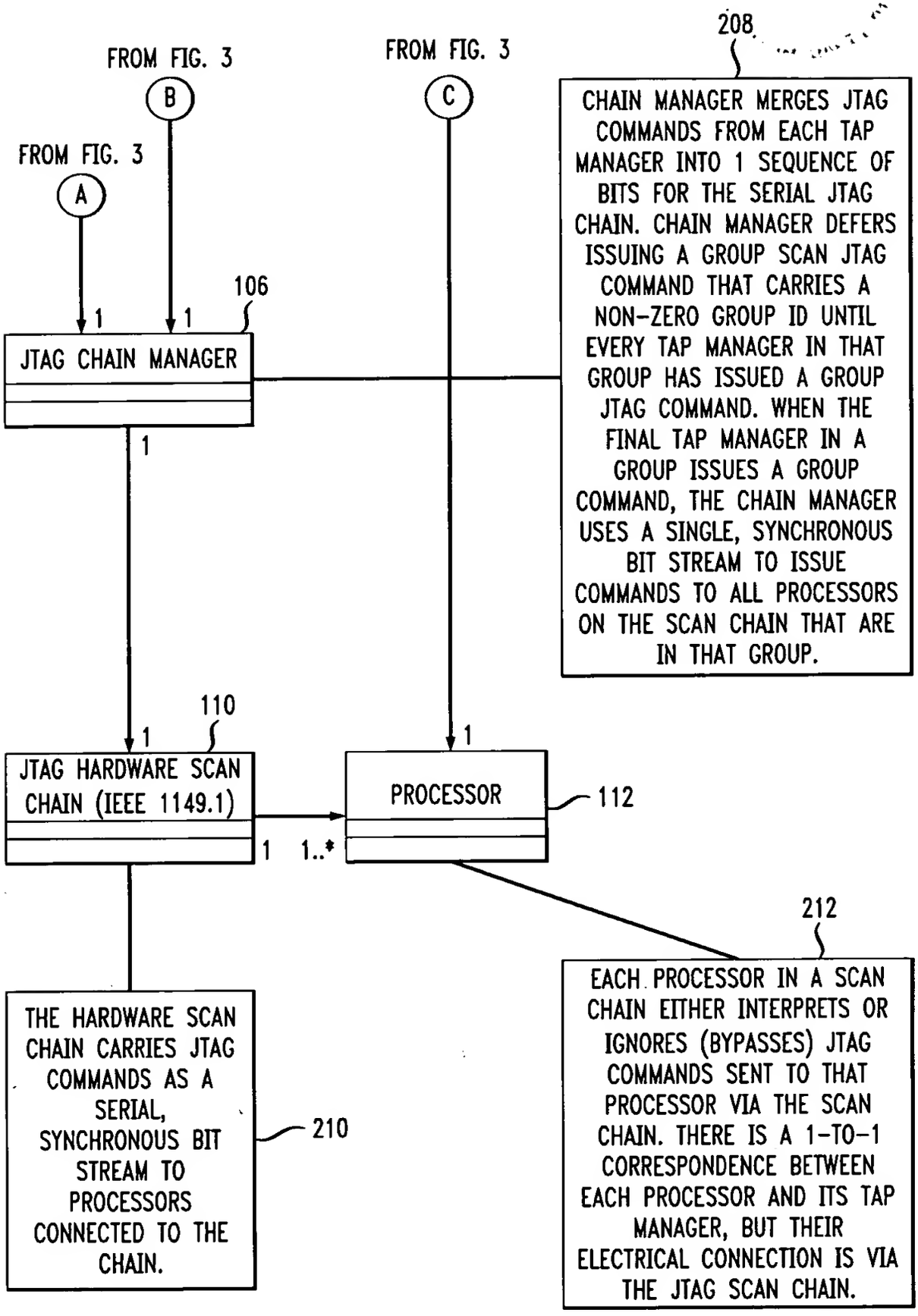
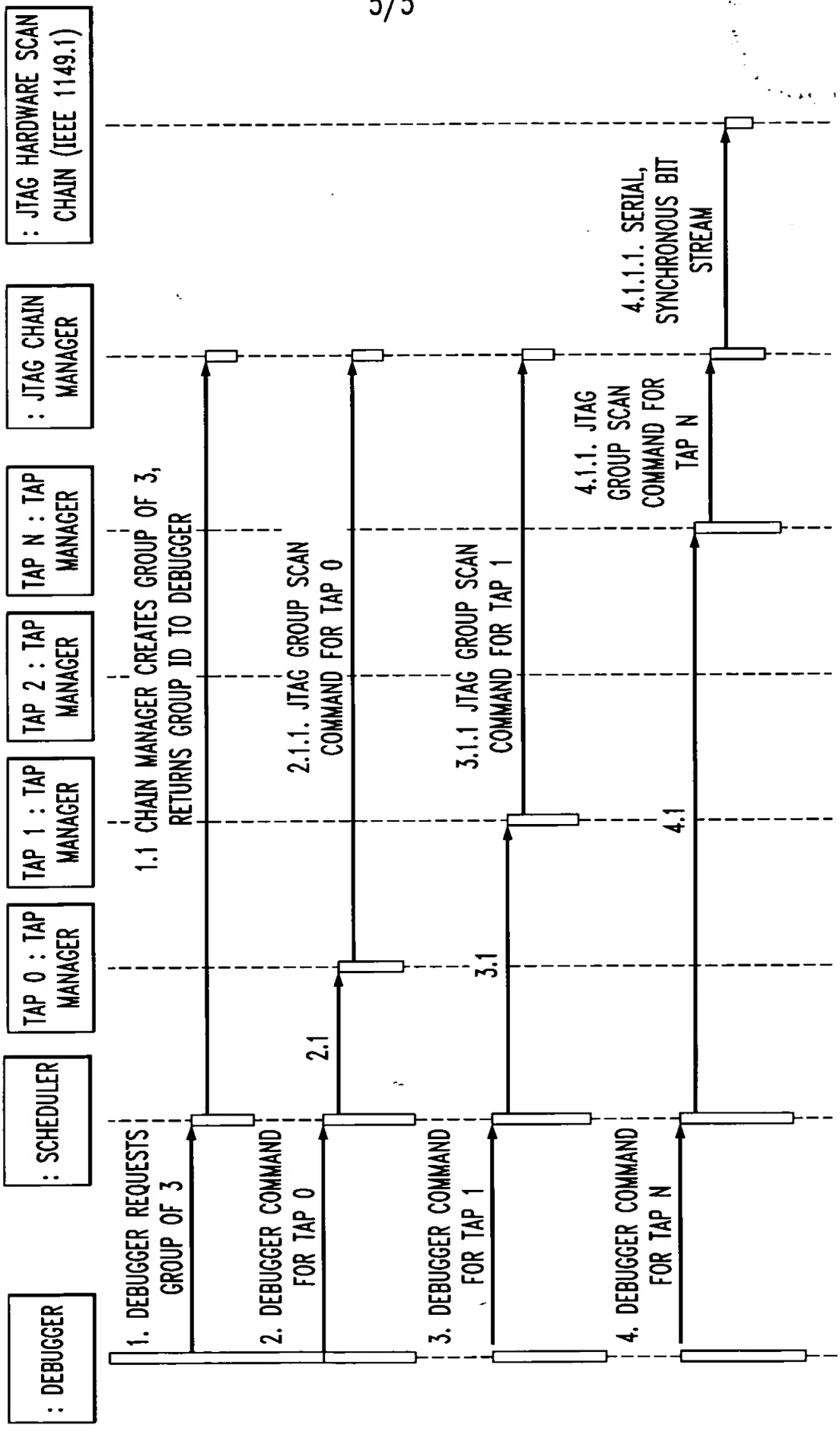

FROM FIG. 3
B
FROM FIG. 3
A
FROM FIG. 3
C
208
CHAIN MANAGER MERGES JTAG COMMANDS FROM EACH TAP MANAGER INTO 1 SEQUENCE OF BITS FOR THE SERIAL JTAG CHAIN. CHAIN MANAGER DEFERS ISSUING A GROUP SCAN JTAG COMMAND THAT CARRIES A NON-ZERO GROUP ID UNTIL EVERY TAP MANAGER IN THAT GROUP HAS ISSUED A GROUP JTAG COMMAND. WHEN THE FINAL TAP MANAGER IN A GROUP ISSUES A GROUP COMMAND, THE CHAIN MANAGER USES A SINGLE, SYNCHRONOUS BIT STREAM TO ISSUE COMMANDS TO ALL PROCESSORS ON THE SCAN CHAIN THAT ARE IN THAT GROUP.
106
1
1
JTAG CHAIN MANAGER
1
110
1
JTAG HARDWARE SCAN CHAIN (IEEE 1149.1)
1
1..*
PROCESSOR
112
1
212
EACH PROCESSOR IN A SCAN CHAIN EITHER INTERPRETS OR IGNORES (BYPASSES) JTAG COMMANDS SENT TO THAT PROCESSOR VIA THE SCAN CHAIN. THERE IS A 1-TO-1 CORRESPONDENCE BETWEEN EACH PROCESSOR AND ITS TAP MANAGER, BUT THEIR ELECTRICAL CONNECTION IS VIA THE JTAG SCAN CHAIN.
THE HARDWARE SCAN CHAIN CARRIES JTAG COMMANDS AS A SERIAL, SYNCHRONOUS BIT STREAM TO PROCESSORS CONNECTED TO THE CHAIN.
210

FIG. 4


: DEBUGGER
: SCHEDULER
TAP 0 : TAP MANAGER
TAP 1 : TAP MANAGER
TAP 2 : TAP MANAGER
TAP N : TAP MANAGER
: JTAG CHAIN MANAGER
: JTAG HARDWARE SCAN CHAIN (IEEE 1149.1)
1. DEBUGGER REQUESTS GROUP OF 3
1.1 CHAIN MANAGER CREATES GROUP OF 3, RETURNS GROUP ID TO DEBUGGER
2. DEBUGGER COMMAND FOR TAP 0
2.1
2.1.1. JTAG GROUP SCAN COMMAND FOR TAP 0
3. DEBUGGER COMMAND FOR TAP 1
3.1
3.1.1 JTAG GROUP SCAN COMMAND FOR TAP 1
4. DEBUGGER COMMAND FOR TAP N
4.1
4.1.1. JTAG GROUP SCAN COMMAND FOR TAP N
4.1.1.1. SERIAL, SYNCHRONOUS BIT STREAM